Space Weather Forecast

Issued on Friday, 21 January 2022 at 12:44 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight daily chance of G1/Minor Geomagnetic Storms from Coronal Mass Ejections (CMEs) throughout.

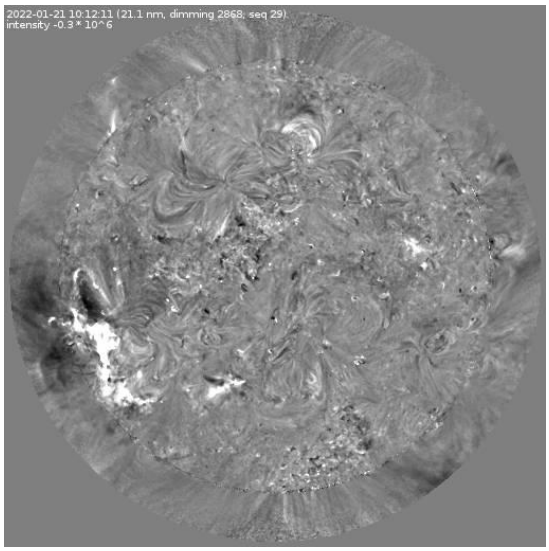
Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity fell to become very low in the past 24 hours, with no significant X-ray flares recorded. The number of sunspots on the facing side of the sun also fell, with just two magnetically unipolar groups now surviving. Two recent large sunspot groups, including that responsible for the recent R2 and S1 alerts, now lie narrowly over the western solar horizon - with small and ever-decreasing chances of producing further X-ray flares or solar radiation storms large enough to be detected at Earth. Finally, a further small and inactive unipolar sunspot became indistinct near the southwest solar horizon.

At 21/0900UTC, a large 'filament' (arc of plasma) disappeared from immediately north of the easternmost surviving sunspot, with this event visible on ground-based near infra-red imagery for the period (e.g. from Udaipur observatory, India). This was tied to a long-lasting but sub-common class X-ray flare. A Coronal Mass Ejection (CME) was visible in available satellite imagery, however this is not considered Earth-directed, with no other events of note observed.

Having being emitted prior to this this 24-hour period, there are numerous potential CME glances and near misses in the forecast - see the 'Solar Wind / Geomagnetic Activity' section for detail.

Figure 1: Time-integrated extreme UV image sequence of the 21/0900UTC ‘filament eruption’ from the southeast of the sun (dark lines lower left). Earth-based effects are considered unlikely. Image processing courtesy of ROB SIDC.



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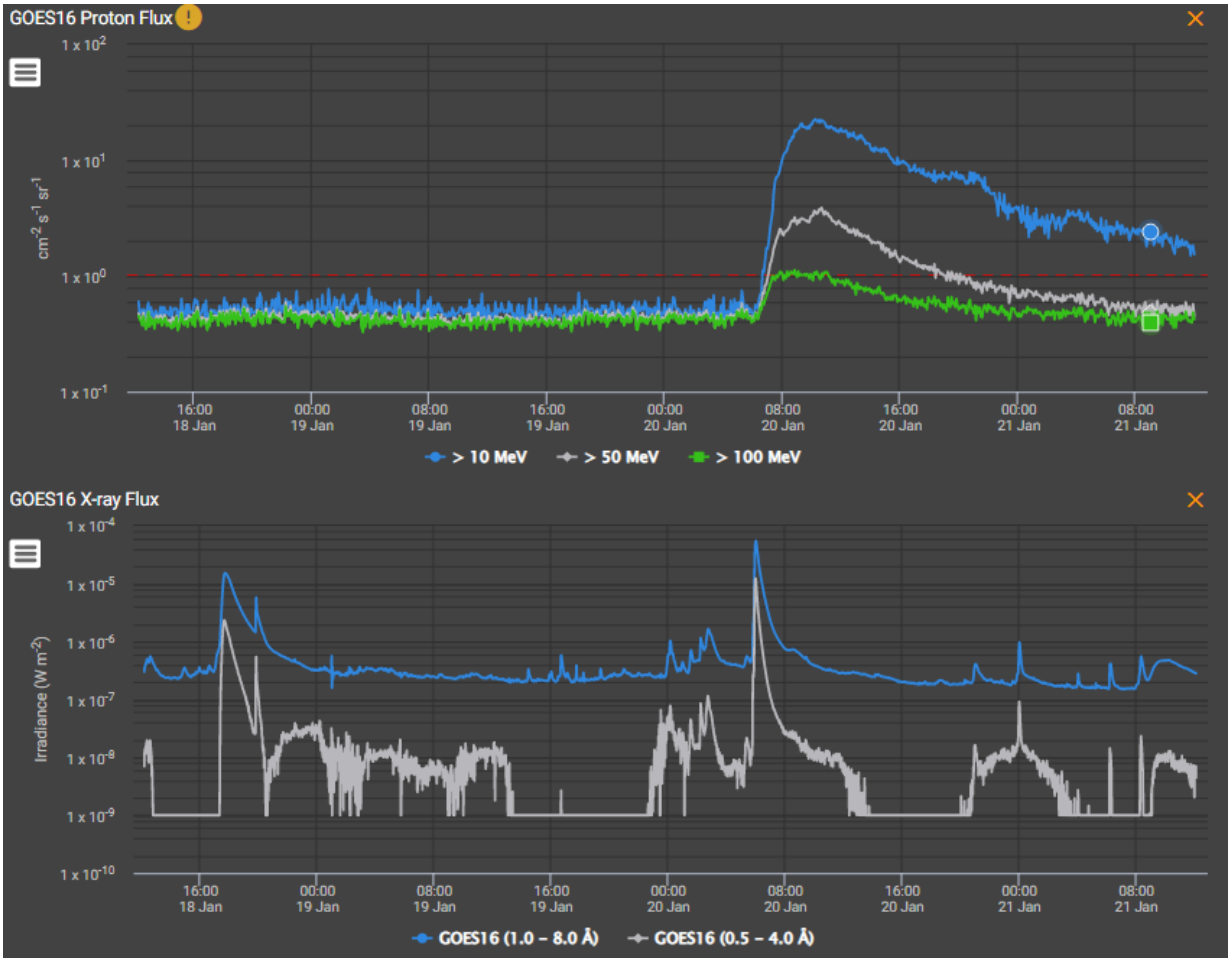
Solar Wind / Geomagnetic Activity: The solar wind was suggestive of an ongoing exit from a fast regime from a 'coronal hole' near the western solar horizon.

The solar wind speed fell in the 24 hours within slightly elevated levels, while the number of particles in the solar wind was unremarkable and showed a slight downward trend. The magnetic field tied to these particles also showed a slight decay - within background levels. The net effect of the above solar wind measures was for provisionally quiet geomagnetic activity throughout - at the very bottom of the measurement scale and well below G1.

Energetic Particles / Solar Radiation: The detected solar radiation storm showed a declining response from S1 to start the period, having initially being reached in the wake of the middle-ranking Moderate class X-ray flare that preceded this 24-hour period. This measurement of solar radiation accordingly crossed below the S1 threshold from 20/2000UTC. The 'harder' solar radiation response (due to more massive protons) also fell, starting the period narrowly below the alert threshold and subsequently falling.

Figure 2: Past three days in: (top) solar radiation storms; (and bottom) X-ray flux, showing the S1 solar radiation storm (blue line, top graph) as well as the 100MeV response (green line) at peak. The observed proton flux from the Moderate class X-ray flare (largest peak on bottom graph, blue and white lines) continues to decay. Note that not all flares produce solar radiation storms, just as not all flares result in CMEs.



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Met Office

Space Weather Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: There continues to be a decreasing slight chance of further isolated Moderate-class X-ray flares given two large sunspots' proximity to the western solar horizon. With an otherwise simple (in terms of sunspots) Earth-facing side of the sun and no returning regions due, very low solar activity is expected into the UTC weekend.

Solar Wind / Geomagnetic Activity: There are three potential CME arrivals through the period. Firstly, there is a chance of a glancing impact either late today (Friday 21 January) or early Saturday from the CME from the Moderate-class X-ray flare on 19 January. Secondly, a CME leaving the southwest of the sun (from an ejected arc of plasma (filament eruption)) on 20 January may brush Earth with limited impacts on day 4 (Monday 24 January). Thirdly, a further CME which occurred on 19 January has the potential to arrive day 3 (Sunday 23 January), with confidence slightly higher for some limited impacts at Earth for this feature.

In addition to the complicated CME forecast, a fast solar wind regime may otherwise re-establish as a pair of 'coronal holes' may feature at Earth from later in the UTC weekend.

The resultant forecast is very low confidence in timing and phasing of Minor Geomagnetic Storm G1 risk, but higher for this being the maximum attained geomagnetic activity. In the absence of especially low confidence CME effects, the trend should otherwise be for quiet ambient activity gradually increasing - given the more reliable fast wind high speeds stream(s) onset(s).

Energetic Particles / Solar Radiation: Solar radiation storms are forecast to slowly decrease back to Background levels of risk in the first half of the forecast period. The chances of further such enhancements should now gradually fall with time from a peak early slight chance - the result of large sunspot regions lying narrowly over the western solar horizon but rotating away with time.

Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Radio Blackouts - X Ray Flares:

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	5	1	1
Very Active	R3 to R5 X	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	Yes	10	5	2	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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